

From: Elizabeth H Gayne
Sent: Friday, July 13, 2018 11:44 AM
To: Patrick Corbett; Michael Kiss; Cheryl Mayo
Cc: Richard B Gangle; Thomas R Andrade
Subject: RE: [External] RE: ACP - Buckingham CS - Air Quality Modeling Report
Attachments: ACP Buckingham pigging emission calc.xlsx; ACP-Buckingham-Capped ESD Volume Calc.xls

Good Morning Pat,

Thank you for the email below bringing to our attention the discrepancy contained in the supplementary excel spreadsheet submitted to the Agency on Friday, June 29th. Specifically, the calculations in the excel spreadsheet for pigging events contained a typo indicating that pigging would occur at 1400 psi. This version of the excel spreadsheet was inadvertently sent to you and rather than the version intended which corresponded with the pdf version presented in the data request response.

As identified in Dominion Energy's revised permit application dated 5/25/18, the 6/29/18 data request response (official signed copy), and the 7/10/18 modeling report, blowdowns from pigging events should be estimated based on a pipeline pressure of 1200 psi.

Attached, please find the excel spreadsheet, recently submitted with our modeling report, containing the calculations consistent with our permit application, modeling report, and data request response on file with the Agency. Also attached are the background calculation for the Station's proposed capped ESD events, per your request.

We apologize for any inconvenience this may have caused. Thank you for your time and we look forward to receiving the draft permit for review and comment.

Sincerely,

Liz

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From: Patrick Corbett [mailto:patrick.corbett@deq.virginia.gov]
Sent: Friday, July 13, 2018 8:22 AM
To: Thomas R Andrade (Services - 6); Michael Kiss
Cc: Cheryl Mayo; Elizabeth H Gayne (Services - 6); Richard B Gangle (Services - 6)
Subject: [External] RE: ACP - Buckingham CS - Air Quality Modeling Report

It has come to my attention that the calculations for pigging events has been altered in this latest submittal without calling that change to our attention. Please submit the underlying calculations used for pig launching and receiving as well as the ESD test event.

From: Thomas R Andrade [mailto:Thomas.R.Andrake@dominionenergy.com]
Sent: Tuesday, July 10, 2018 4:29 PM
To: Kiss, Michael <Michael.Kiss@deq.virginia.gov>
Cc: Corbett, Patrick <Patrick.Corbett@deq.virginia.gov>; Cheryl Mayo <cheryl.mayo@deq.virginia.gov>; Elizabeth H Gayne <Elizabeth.H.Gayne@dominionenergy.com>; Richard B Gangle <richard.b.gangle@dominionenergy.com>
Subject: ACP - Buckingham CS - Air Quality Modeling Report

Hi Mike,

Please find attached the updated Air Quality Modeling Report for the new Buckingham Compressor Station. The hard copy version of the updated report is being sent overnight. Also I have included the emissions calculations spreadsheet.

If you have questions about this submittal or need additional information, please do not hesitate to contact me.

Thanks!!!

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VOLUME CALCULATION -BUCKINGHAM CAPPED ESD TEST

LENGTH OF PIPE	OUTSIDE DIAMETER (in.)	WALL THK. (in.)	INSIDE DIAMETER	INTERNAL AREA (in.)^2	CU. FT. PER LINERAL FT. PIPE	TOTAL ACTUAL CU.FT	TOTAL GALLONS	COMMENTS
3	10.750	0.500	9.750	74.662	0.518	1.555	11.636	
3	10.750	0.500	9.750	74.662	0.518	1.555	11.636	
3	10.750	0.500	9.750	74.662	0.518	1.555	11.636	
2	4.500	0.237	4.026	12.730	0.088	0.177	1.323	
2	4.500	0.237	4.026	12.730	0.088	0.177	1.323	
2	4.500	0.237	4.026	12.730	0.088	0.177	1.323	
2	4.500	0.237	4.026	12.730	0.088	0.177	1.323	

TOTAL CU. FT. =	5.3736	40.1974
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**Buckingham Compressor Station
Pigging Emission Estimates¹**

Project Location	Location	Chamber Volume Per Event ²	Gas Temperature	Line Pressure ³	Volume of Pressurized Gas (ft ³) ⁴	Compressibility Factor ⁵	Pressurized Density (lb/ft ³)	Atmospheric Density (lb/ft ³)	Delta Density	Gas Vented Per Event	Max Events Per Year	Emission Estimate ⁶			
		(cf)	(°F)	(psi)	Ideal Gas Law : (V ₁ * P ₁) / P ₂	Z	$\rho_1 = (P_1 * MW) / R * T_1 * Z$	$\rho_2 = (P_2 * MW) / R * T_2 * Z$	(lb/ft ³)	(lbs)		VOC (tons)	CO ₂ (tons)	CH ₄ (tons)	CO ₂ e (tons)
Buckingham CS	Launcher	382.8	85	1,200	31.632	0.87356	4.0831	0.0000	4.083	1,563.0	4	0.081	0.083	2.75	68.9
	Receiver	399.2	85	1,200	32.987	0.87356	4.0831	0.0000	4.083	1,630.0	4	0.085	0.087	2.87	71.8
	TOTAL											0.166	0.170	5.62	140.7
PROJECT TOTALS												0.166	0.170	5.62	140.7

- Emission calculations from the Pennsylvania Department of Environmental Protection's Midstream Emissions Calculation spreadsheet.
- Chamber volume based upon the dimensions of the barrel and piping sections (42 - 48" diameter) from DETI
- Line pressure based on the maximum operating pressure of the line
- Volume of pressurized gas based on line chamber volume, temperature, and pressure corrected to standard conditions.
- Compressibility factor based on engineering estimate provided by DETI.
- Emission Rate (tons) = Gas Vented Per Event (lbs) x Number of Events ÷ 2,000 x constituent weight percent

GAS ANALYSIS					
Vapor Component		Mole % ³	Molecular Weight (lb/lb mole)	Average Molar Mass (lb/lbmole) ⁴	Weight % ⁵
Nitrogen	N2	0.994	28.02	0.2785	1.62%
Methane	CH4	94.206	16.04	15.1106	88.00%
Carbon Dioxide	CO2	1.041	44.01	0.4581	2.67%
Ethane	C2H6	2.923	30.07	0.8789	5.12%
Propane	C3H8	0.546	44.1	0.2408	1.40%
i-Butane	iC4H10	0.079	58.1	0.0459	0.27%
n-Butane	nC4H10	0.084	58.1	0.0488	0.28%
i-Pentane	iC5H12	0.024	72.2	0.0173	0.10%
n-Pentane	nC5H12	0.022	72.2	0.0159	0.09%
n-Hexane	nC6H14	0.032	86.2	0.0276	0.16%
Methylcyclohexane	C7H14	0.000	98.2	0.0000	0.00%
Toluene	C7H8	0.000	92.1	0.0000	0.00%
Heptane (C7)	C7H16	0.049	100.2	0.0491	0.29%
Octane (C8)	C8H18	0.000	114.2	0.0000	0.00%
Total			17.1716		100.00%
VOC Wt %					2.6%

- Mole percent for vapor components are from representative gas analysis.
- Average Molar Mass = \sum (Mole fraction, x Molecular Weight).
- Weight Percent = Molecular Weight, / Average Molar Mass x 100%.